FORM PCT 1390 REV. 5/93 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NO: GEBLER ET AL-1 PCT

U.S. APPLICATION NO (If known, see 37 CFR 1.5): 10/048099

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE00/02445	JULY 25, 2000	JULY 27, 1999

TITLE OF INVENTION
FILTER BODY OF A FLUID, ESPECIALLY AN AIR FILTER

APPLICANT(S) FOR DO/EO/US
CLAUDE GEBLER ET AL

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. X This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ___ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. X This is an express request to begin national examination procedures (35 U.S.C. 371 (f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l).
4. X A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. X A copy of the International Application as filed (35 U.S.C. 371(c)(2)
   a. X is transmitted herewith (required only if not transmitted by the International Bureau)
   b. ___ has been transmitted by the International Bureau.
   c. ___ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. X A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ___ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
   a. ___ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ___ have been transmitted by the International Bureau.
   c. ___ have not been made; however, the time limit for making such amendments has **NOT** expired.
   d. ___ have not been made and will not be made.
8. ___ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. X An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ___ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. X An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. X An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. X A **FIRST** preliminary amendment.
    ___ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ___ A substitute specification.
15. ___ A change of power of attorney and/or address letter.
16. X Other items or information:

    PCT/ISA/210 - Int'l. Search Report (English)

    TWO SHEETS OF FORMAL DRAWINGS

Applicant Claims Priority under 35 U.S.C. §119 of GERMANY Application No. 199 35 297.6 , filed: 27 JULY 1999 .
Applicant Claims Priority under 35 U.S.C. §120 of: PCT No. PCT/DE00/02445 , filed: 25 JULY 2000 .

APPLICATION NO. (if known, see 37 CFR 1.5) 10/048099	INTERNATIONAL APPLICATION NO PCT/DE00/02445	ATTORNEY'S DOCKET NO GEBLER ETAL-1PCT
X The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)):		
Search Report has been prepared by the EPO or JPO.....**$890.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.482) **$710.00**		
Neither international preliminary examination fee paid (37 CFR 1.82) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....**$1,040.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4).....$100		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 890.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ___ 20 ___ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		

Claims	Number Filed	Number Extra	Rate		
Total Claims	10 - 20 =	- 0 -	X **$18.00**	$	
Independent Claims	1 - 3 =	- 0 -	X **$84.00**	$	
Multiple dependent claim(s) (if applicable)			+ **$280.00**	$ 890.00	
TOTAL OF ABOVE CALCULATIONS =				$	
Reduction by 1/2 for Small Entity status, if applicable.				$	
SUBTOTAL =				$ 890.00	
Processing fee of **$130.00** for furnishing the English translation later than ___ 20 ___ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$ 890.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ 40.00	
TOTAL FEES ENCLOSED =				$ 930.00	
				Amount to be: refunded	$
				charged	$

_____ Applicant claims Small Entity status.

a. X A check in the amount of $ 930.00 to cover the above fees is enclosed.

b. ___ Please charge my Deposit Account No. 03-2468 in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. X The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment, to Deposit Account No. 03-2468. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:
COLLARD & ROE, P.C.
1077 Northern Boulevard
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Date of Deposit January 24, 2002

Signature

Edward R. Freedman, Reg. No. 26,048

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10, on the date indicated above, and is addressed to the Commissioner for Patents, U.S. PTO, P.O. Box 2327, Arlington, VA 22202

Lisa L. Vulpis

Lisa L. Vulpis

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: CLAUDE GEBLER ET AL

PCT NO.: PCT/DE00/02445 PCT FILED: JULY 25, 2000

PRIORITY: DE 199 35 297.6 PRIORITY FILED: JULY 27, 1999

TITLE: FILTER BODY OF A FLUID FILTER, ESPECIALLY AN AIR FILTER

PRELIMINARY AMENDMENT

ATTN.: BOX PCT APPLICATION
Ass't. Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Preliminary to the initial Office Action, please amend the above-identified application as follows:

IN THE SPECIFICATION:

On Page 1, line 1, please insert the following paragraphs:

--CROSS REFERENCE TO RELATED APPLICATIONS

Applicants claim priority under 35 U.S.C. §119 of German Application No. 199 35 297.6, filed on July 27, 1999. Applicants also claim priority under 35 U.S.C. §120 of PCT/DE00/02445, filed on July 25, 2000. The international application under PCT article 21(2) was not published in English.--

On page 1, please replace the first complete paragraph with the following paragraph:

--The invention relates to a filter body of a fluid filter, especially an air filter, having the features of the definition of the species of claim 12. Fluid filters are used, for example, as air filters or oil filters or fuel filters in motor vehicles.--

On page 1, please replace the second complete paragraph with the following rewritten paragraph:

--German Utility Model DE 88 05 049 U1 discloses a filter body of the type defined above, having a filter element consisting of a folded filter material in the form of a cylindrical tube. Because of these folds or pleats, such a tubular cylindrical filter element is also known as a star filter. An end disk is usually attached to both of the axial ends of this filter element, thus forming a seal with a radial action. This seal comes to rest radially against a cylindrical sealing face in the case of a filter body inserted into a filter housing. This sealing face is usually provided on a connection of the filter housing which is arranged coaxially with respect fo the filter body and to which the filter body is attached or which is inserted into the filter body when at least one of the end disks is designed as an end disk that is open at the center.--

On page 2, please replace the second complete paragraph with the following rewritten paragraphs:

--However, it is relatively complicated and expensive to manufacture such a filter body, because in a first manufacturing step, the filter element is attached to one side of the end disk by means of a special joining technique, e.g. by plastification by means of ultrasound or by heating level softening, and in a second manufacturing step the supporting means must be attached to the other side of the end disk through a corresponding joining technique. In addition, an additional production step may be necessary to attached the seal to the end disk with a suitable joining technique. A simplification is obtained when the supporting means are already integrated into the end disk in the form of an annular collar at the time of production of the end disk, so that a joining method can be used for securing the supporting means. Since filter bodies are usually mass-produced products, eliminating a manufacturing step means a considerable economic advantage.

International Patent WO 97/41939 discloses a filter body in which the filter element is equipped with an open end disk on one axial end. On its radial inside edge, this end disk has an axial annular collar which forms a seal which acts radially. Between the annular collar and the filter element may be inserted a ring-shaped body

which functions as a radial support for the annular collar.

British Patent 1,499,922 discloses a filter body whose filter element is equipped with end disks on its axial ends. Several sealing lips are molded on the end disks.

French Patent Application 1,186,929 A discloses a ring-shaped sealing element which is equipped with sealing lips that project axially. When installed, the sealing lips are deformed axially toward one another, thus producing a preliminary stress which creates the axial sealing effect.

Filter bodies of this type are relatively unstable and cannot be exposed to any especially great pressure differences.--

On page 2, please replace the last two complete paragraphs with the following paragraphs:

--This problem is solved according to this invention by a filter body having the features of claim 12.

Due to the inner frame proposed according to this invention, the stability of the filter body can be improved significantly. First, the filter element can be supported on the inner frame on the inside radially, so that the stability of the filter element with

respect to radial pressure differences is increased. Secondly, the two end disks are supported axially on one another by means of the inner frame, so that forces acting axially on the filter body are transferred essentially not to the filter element but instead to the stable inner frame. Due to the increased stability, the filter body according to this invention has a longer lifetime and a broader spectrum of use.--

On page 5, please replace the last paragraph with the following paragraph:

--An inner frame 13 provided in the interior 12 of the filter element 2 serves to provide radial support for the filter element 2. The inner frame 13 her is also attached to the end disk 3 and serves at the same time to provide axial support for the end disks 3.--

A marked-up copy of these paragraphs is attached.

IN THE CLAIMS:

Please cancel claims 1-11 and replace with new claims 12-21 as attached hereto.

REMARKS

By this Preliminary Amendment, the application has been amended to conform with U.S. practice, the cross-reference to the related application has been inserted on page 1. Also, claims 1-11 have been replaced by new claims 12-21. No new matter has been introduced.

Entry of this amendment is respectfully requested.

Respectfully submitted,

CLAUDE GEBLER ET AL

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Lisa L. Vulpis

Lisa L. Vulpis

10/048099
PCT/DE00/02445
531 Rec'd PCT 24 JAN 2002

FILTER BODY OF A FLUID FILTER, ESPECIALLY AN AIR FILTER

This invention relates to a filter body of a fluid filter, especially an air filter, having the features of the definition of the species of claim 1. Fluid filters are used, for example, as air filters or oil filters or fuel filters in motor vehicles.

A traditional filter body of the type defined above has a filter element consisting of a folded filter material in the form of a cylindrical tube. Because of these folds or pleats, such a tubular cylindrical filter element is also known as a star filter. An end disk is usually attached to both of the axial ends of this filter element, thus forming a seal with a radial action. This seal comes to rest radially against a cylindrical sealing face in the case of a filter body inserted into a filter housing. This sealing face is usually provided on a connection of the filter housing which is arranged coaxially with respect to the filter body and to which the filter body is attached or which is inserted into the filter body when at least one of the end disks is designed as an end disk that is open at the center.

Since the seals on the filter body act radially, for the filter body there is essentially the possibility of an axial adjustment within the filter housing. This axial adjustability is required, for example, to compensate for dimensional deviations due to tolerance between the filter housing and the filter body. Due to this axial adjustability, a certain relative movement between the filter body and the filter housing is possible in principle, but such movement is not desirable because it can have a negative effect on the sealing effect of the seals and because this relative movement can also lead to a problematical noise generation in operation of a vehicle equipped with these filters.

To prevent such a relative movement between the filter body and the filter housing, supporting means are mounted on the axial outside of the end disk with respect to the filter element and extend in a ring pattern there. These supporting means are designed with axial elasticity and in the case of a filter body inserted into the filter housing, they are in turn supported on a supporting contour which is designed on the filter housing and extends parallel to the end disk. Due to this support, there is an axial positioning of the filter body and the filter housing which suppresses relative movements between the filter body and the filter housing. Such supporting means may be designed in the form of a foam ring mounted on the end disk, for example.

However, it is relatively complicated and expensive to manufacture such a filter body, because in a first manufacturing step, the filter element is attached to one side of the end disk by means of a special joining technique, e.g. by plastification by means of ultrasound or by heating level softening, and in a second manufacturing step the supporting means must be attached to the other side of the end disk through a corresponding joining technique. In addition, an additional production step may be necessary to attach the seal to the end disk with a suitable joining technique.

The present invention is concerned with the problem of designing a filter body of the type defined in the preamble such that the expense required for its production are reduced.

This problem is solved according to this invention by a filter body having the features of claim 1. 12

This invention is based on the general idea of integrating the supporting means in the form of an annular collar into

the end disk at the time of production of the end disk, so that the joining method for attaching the supporting means can be eliminated. Since filter bodies are usually mass produced, eliminating one manufacturing step means a considerable economic advantage.

According to an especially advantageous refinement of this invention, the annular collar which forms the supporting means as well as the end disk and the seal may all be designed in one piece as an injection-molded plastic unit, thereby also eliminating a joining operation for attaching the seal. The end disk designed in this way then need only be joined to the filter element and optionally to an inner frame to form a fully functional filter body.

In one refinement of this invention, the seal may be designed on the annular collar, thus yielding a design that is simple to manufacture. This variant can be improved upon especially expediently by having the seal and the annular collar work together in such a way that an increasing axial deformation of the annular collar causes an increasing radial adjustment of the seal in the direction of its radial sealing action. This has the result that axial distortion of the sealing body is associated with an increase in the preliminary tension on the seal and thus an improved sealing effect.

Other important features and advantages of the present invention are derived from the subordinate claims, the drawings, and the respective description of the figures with reference to the drawings.

It is self-evident that the features mentioned above and those to be discussed in detail below can be used not only in the combination given here but also in other combinations, or they may also be used alone, without going beyond the scope of the present invention.

The end disks 3 are designed as open end disks 3, and to this end they each have a central opening 4. An annular collar 6 is formed on the inside edge 5 of this opening 4 on the end disk 3 and projects axially outward from the end disk 3 with respect to the filter element 2. The annular collar 6 has at least two axial sections 7 and 8, and the axial section 8 which is arranged closer to the end disk 3 has a decreasing inside diameter with an increase in the distance from the end disk 3, while the inside diameter of the axial section 7, which is arranged a greater distance away from the end disk 3, increases with an increase in the distance from the end disk 3. The two axial sections 7 and 8 are connected to one another by a connecting section 9, which has the smallest inside diameter of the annular collar 6 and forms a ring-shaped sealing lip which acts radially toward the inside.

This sealing lip 9 serves as a radially acting seal of the end disk 3, which comes to rest on a sealing face 10 when filter body 1 is inserted into a filter housing. Sealing face 10 is designed here on a cylindrical connection 22, which forms a part of the filter housing (not otherwise shown here) and extends coaxially with the filter body 1. Although the seal (sealing lip 9) comes to rest radially on the sealing face 10, the axial section 7 of the annular collar 6 which is located farther toward the outside axially comes to rest axially on a supporting contour 11, which is designed here in the form of a ring disk and extends parallel to the end disk 3.

An inner frame 13 provided in the interior 12 of the filter element 2 serves to provide radial support for the filter element 2. The inner frame 13 here is also attached to the end disk 3 and serves at the same time to provide axial support for the end disks 3. Likewise, an embodiment in which the filter body 1 which does not contain any inner frame 13 is also possible.

CLAIMS

12. A filter body of a fluid filter, especially an air filter having the following features:

- the filter body (1) has a tubular cylindrical filter element (2) made of a filter material,

- an end disk (3) is mounted on at least one axial end of the filter element (2),

- the end disk (3) has a seal (9) which acts radially and which comes to rest radially on a cylindrical sealing face (10) in the case of a filter body (1) inserted into a filter housing, said sealing face being arranged coaxially with respect to the filter body (1),

- the end disk (3) has supporting means (6, 15) extending in a ring-shaped design on the outside axially of the end disk (3) with respect to the filter element (2),

- the supporting means (6, 15) are designed with axial elasticity and are supported on a supporting contour (11) which is formed on the filter housing and extends parallel to the end disk (3) in the case of a filter body (1) inserted into the filter housing, so that the filter body (1) is positioned axially in the filter housing,

- the supporting means have an annular collar (6) which projects axially outward away from the end disk (3) with respect to the filter element (2) and is designed with axial elasticity in an axial section (15),

- in the case of a filter body (1) inserted into the filter housing, the elastic section (15) is supported axially on the supporting contour (11),

- annular collar (6) and end disk (3) are made of an injection-molded plastic in one piece,

characterized in that

the filter body (1) has an inner frame (13) which supports the filter element (2) radially and supports the end disks (3) axially.

13. A filter body according to claim 12,

characterized in that

the annular collar (6), the end disk (3) and the seal (9) are designed as an injection-molded unit made of plastic in one piece.

14. A filter body according to claim 12,

characterized in that

the seal (9) is formed on the annular collar (6).

15. A filter body according to claim 14,

characterized in that

the seal (9) and the annular collar (6) work together in such a way that an increasing axial deformation of the annular collar (6) causes an increasing radial adjustment of the seal (9) in the direction of its radial sealing effect.

16. A filter body according to claim 13,

characterized in that

the unit comprising the annular collar (6) and the seal (9) consists of at least two axial sections (7, 8) which are joined together by a connecting section (9), where the connecting section forms a ring-shaped sealing lip (9) which acts radially inward, and the axial section (7) arranged at a greater distance away axially is supported on the supporting contour (11), with the axial section (7) which is arranged farther toward the outside axially being inclined away from the sealing face (10), starting from the sealing lip (9), while the axial section (8) which is arranged farther inward axially runs at an inclination toward the sealing face (10), starting from the sealing lip (9).

17. A filter body according to claim 12,

characterized in that

the annular collar (6) has a corrugated or zigzag-shaped profile in a central longitudinal section.

18. A filter body according to at least claim 16,

characterized in that

a unit comprising the material thickness of the seal (9) and the annular collar (6), as measured in the profile, decreases in the axial section (8) facing the end disk (3) as far as the connecting section (9) with an increase in the distance from the end disk (3) while being essentially constant in the axial section (7) which faces away from the end disk (3).

19. A filter body according to claim 12,

characterized in that

the sealing face (10) is formed by a cylindrical outer jacket of a connection (22) which extends coaxially with the filter body (1) inside the filter housing, and the end disk (3) has a central opening (4) on whose inside edge (5) the annular collar (6) is provided.

20. A filter body according to claim 12,

characterized in that

the two axial ends of the filter element (2) are each equipped with one of these end disks (3), so that the filter body (1) inserted into the filter housing is centered axially in the filter housing.

21. A filter body according to according to claim 12,

characterized in that

TEEE is used to produce the unit consisting of the end disk (3) and the annular collar (6).

FILTER BODY OF A FLUID FILTER, ESPECIALLY AN AIR FILTER

This invention relates to a filter body of a fluid filter, especially an air filter, having the features of the definition of the species of claim 1. Fluid filters are used, for example, as air filters or oil filters or fuel filters in motor vehicles.

A traditional filter body of the type defined above has a filter element consisting of a folded filter material in the form of a cylindrical tube. Because of these folds or pleats, such a tubular cylindrical filter element is also known as a star filter. An end disk is usually attached to both of the axial ends of this filter element, thus forming a seal with a radial action. This seal comes to rest radially against a cylindrical sealing face in the case of a filter body inserted into a filter housing. This sealing face is usually provided on a connection of the filter housing which is arranged coaxially with respect to the filter body and to which the filter body is attached or which is inserted into the filter body when at least one of the end disks is designed as an end disk that is open at the center.

Since the seals on the filter body act radially, for the filter body there is essentially the possibility of an axial adjustment within the filter housing. This axial adjustability is required, for example, to compensate for dimensional deviations due to tolerance between the filter housing and the filter body. Due to this axial adjustability, a certain relative movement between the filter body and the filter housing is possible in principle, but such movement is not desirable because it can have a negative effect on the sealing effect of the seals and because this relative movement can also lead to a problematical noise generation in operation of a vehicle equipped with these filters.

To prevent such a relative movement between the filter body and the filter housing, supporting means are mounted on the axial outside of the end disk with respect to the filter element and extend in a ring pattern there. These supporting means are designed with axial elasticity and in the case of a filter body inserted into the filter housing, they are in turn supported on a supporting contour which is designed on the filter housing and extends parallel to the end disk. Due to this support, there is an axial positioning of the filter body and the filter housing which suppresses relative movements between the filter body and the filter housing. Such supporting means may be designed in the form of a foam ring mounted on the end disk, for example.

However, it is relatively complicated and expensive to manufacture such a filter body, because in a first manufacturing step, the filter element is attached to one side of the end disk by means of a special joining technique, e.g. by plastification by means of ultrasound or by heating level softening, and in a second manufacturing step the supporting means must be attached to the other side of the end disk through a corresponding joining technique. In addition, an additional production step may be necessary to attach the seal to the end disk with a suitable joining technique.

The present invention is concerned with the problem of designing a filter body of the type defined in the preamble such that the expense required for its production are reduced.

This problem is solved according to this invention by a filter body having the features of claim 1.

This invention is based on the general idea of integrating the supporting means in the form of an annular collar into

the end disk at the time of production of the end disk, so that the joining method for attaching the supporting means can be eliminated. Since filter bodies are usually mass produced, eliminating one manufacturing step means a considerable economic advantage.

According to an especially advantageous refinement of this invention, the annular collar which forms the supporting means as well as the end disk and the seal may all be designed in one piece as an injection-molded plastic unit, thereby also eliminating a joining operation for attaching the seal. The end disk designed in this way then need only be joined to the filter element and optionally to an inner frame to form a fully functional filter body.

In one refinement of this invention, the seal may be designed on the annular collar, thus yielding a design that is simple to manufacture. This variant can be improved upon especially expediently by having the seal and the annular collar work together in such a way that an increasing axial deformation of the annular collar causes an increasing radial adjustment of the seal in the direction of its radial sealing action. This has the result that axial distortion of the sealing body is associated with an increase in the preliminary tension on the seal and thus an improved sealing effect.

Other important features and advantages of the present invention are derived from the subordinate claims, the drawings, and the respective description of the figures with reference to the drawings.

It is self-evident that the features mentioned above and those to be discussed in detail below can be used not only in the combination given here but also in other combinations, or they may also be used alone, without going beyond the scope of the present invention.

Preferred embodiments of this invention are illustrated in the drawings and explained in greater detail in the following description.

The figures show, in the form of schematic diagrams:

Figure 1: a longitudinal section through a filter body according to this invention,

Figure 2: a detailed view of a section labeled as II in Figure 1, showing the filter body in a first relative position with respect to a filter housing,

Figure 3: a view like that in Figure 2, but in a different position relative to the filter housing,

Figure 4: a view like that in Figure 2, but showing a different embodiment.

According to Figure 1, a filter body 1 according to this invention has a filter element 2, which is formed by a tubular cylindrical, folded filter material. An end disk 3 is attached to both axial ends of the filter element 2, said end disks being designed identically in the preferred embodiment illustrated here.

The end disk 3 is attached to the filter element 2 by plastification by ultrasound, for example, or by hot level heating, where the outside of the end disk 3 which is facing filter element 2 is softened. Then the filter material can penetrate into the end disk 3, and the filter material, which is made of a nonwoven material or filter paper in particular, is permeated by the molten plastic of the end disk. After solidification of the plastic of the end disk, the result is a very strong bond of the end disk 3 to the filter element 2.

The end disks 3 are designed as open end disks 3, and to this end they each have a central opening 4. An annular collar 6 is formed on the inside edge 5 of this opening 4 on the end disk 3 and projects axially outward from the end disk 3 with respect to the filter element 2. The annular collar 6 has at least two axial sections 7 and 8, and the axial section 8 which is arranged closer to the end disk 3 has a decreasing inside diameter with an increase in the distance from the end disk 3, while the inside diameter of the axial section 7, which is arranged a greater distance away from the end disk 3, increases with an increase in the distance from the end disk 3. The two axial sections 7 and 8 are connected to one another by a connecting section 9, which has the smallest inside diameter of the annular collar 6 and forms a ring-shaped sealing lip which acts radially toward the inside.

This sealing lip 9 serves as a radially acting seal of the end disk 3, which comes to rest on a sealing face 10 when filter body 1 is inserted into a filter housing. Sealing face 10 is designed here on a cylindrical connection 22, which forms a part of the filter housing (not otherwise shown here) and extends coaxially with the filter body 1. Although the seal (sealing lip 9) comes to rest radially on the sealing face 10, the axial section 7 of the annular collar 6 which is located farther toward the outside axially comes to rest axially on a supporting contour 11, which is designed here in the form of a ring disk and extends parallel to the end disk 3.

An inner frame 13 provided in the interior 12 of the filter element 2 serves to provide radial support for the filter element 2. The inner frame 13 here is also attached to the end disk 3 and serves at the same time to provide axial support for the end disks 3. Likewise, an embodiment in which the filter body 1 which does not contain any inner frame 13 is also possible.

As shown in Figures 1 through 4, the end disk 3, annular collar 6 and seal 9 form a single unit which is preferably made of plastic in one piece by injection molding. The plastic used for this should have enough stiffness to provide reinforcement for filter element 2, and on the other hand it should have elastic properties which permit a sealing effect on the one hand while also permitting a spring action on the other hand. Due to the elastic properties of the plastic used to form the annular collar 6, a type of joint is formed in the area of the ring-shaped connecting zone 9, permitting swiveling adjustments of the axial section 7 which is connected to this on the outside axially and by means of which the angle of inclination of this axial section 7 can be varied in the profile with respect to the longitudinal axis 14 of the filter body 1. However, due to the reversibility of the material, these adjusting movements are elastic, so that an axial end section 15 which faces away from the end disk 3 and is represented by a curly bracket in Figure 1 is designed with axial elasticity.

When the filter body 1 is inserted into the respective filter housing, this axial end section 15 or section 7, which is on the outside axially, is supported on the supporting contour 11, so that the filter body 1 is positioned axially in the filter housing. In this embodiment, both of the end disks 3 are equipped with these supporting means 6, 15, so this yields an axial centering effect for the filter body 1. The supporting means 6, 15 prevent movement of the filter body 1 relative to the filter housing, so that wear phenomena and noise are reduced.

Due to the radially acting seal 9 on both end disks 3, the filter body 1 is mounted so that it is axially movable on the connection 22. Due to the positioning or centering of filter body 1, which is achieved with the help of the

supporting means 6, 15, an optimum relative position between the filter body 1 and the housing is always guaranteed.

The functioning of the supporting means (annular collar 6 and axial section 15) is illustrated in Figures 2 and 3.

According to Figures 2 and 3, the filter body 1 according to this invention is fully functional in a relatively large tolerance range with regard to the axial extent of the filter body 1 on the one hand and the axial distance of the supporting contours 11, which are opposite one another in the housing, on the other hand. In Figure 2 the opposing supporting contours 11 are a relatively great distance apart, so there is little or no axial deformation of the elastic section 15. In contrast with that, the opposing supporting contours 11 in Figure 3 are a relatively small distance apart, with the result that the elastic area 15 undergoes relatively great elastic deformation axially.

The profiling of the annular collar 6, which forms the seal 9 and the supporting means and has four axial ring sections on the end disk 3, beginning with an increasing distance from the end disk 3, namely a first ring section 16, a second ring section 17, a third ring section 18 and a fourth ring section 19, each being characterized by a curly bracket, should also be pointed out here. In the first ring section 16, an inside diameter 20 and an outside diameter 21 are constant, so the thickness of the material of the annular collar 6 is constant in this first ring section 16. In the second ring section 17, the inside diameter 20 remains constant while the outside diameter 21 decreases continuously with an increase in the distance from the end disk 17, so the thickness of the material is reduced here. In the third ring section 18, the inside diameter 20 as well as the outside diameter 21 are reduced to the same extent, so the thickness of the material remains

essentially constant in this section 18. In the fourth section 19, both the inside diameter 20 as well as the outside diameter 21 increase again uniformly with an increase in the distance from the end disk 3, so that here again, the thickness of the material remains essentially constant. Consequently, the smallest inside diameter 20 occurs in the connecting section 9 which forms the sealing lip, so that this yields a linear seal.

If the distance between the supporting contour 11 and the end disk 3 facing it is reduced from the transition of the relative position according to Figure 2 to the relative position according to Figure 3, for example, then in the elastically deformable axial section 15, an end 23 which is in contact with the supporting contour 11 is adjusted radially outward, thus producing a restoring force which acts radially inward in the elastically deformable section 15. This restoring force, which acts inward radially, supports the seal 9 which acts inward radially, so the sealing effect of this seal 9 is improved. In addition, the seal 9 and the axial section 7 which is in contact with the supporting contour 11 are both made of the same plastic, because the seal 9 is integrally molded on the annular collar 6, so that an axial seal is also achieved additionally on the supporting contour 11 and increases with an increase in the axial distortion of the filter body 1 in the housing.

In the embodiment illustrated in Figures 1 - 3, the annular collar 6 has only one axial section having an approximately V-shaped profile in the longitudinal center section, with a section 8 inclined toward the sealing face and a section 7 inclined away from the sealing face 10, but in the embodiment according to Figure 4, several such V-shaped sections are aligned in a row axially, thus yielding on the whole a corrugated or zigzag-shaped profile for the annular collar 6 in the longitudinal center section. The axially

flexible section 15 thus extends over the entire axial length of the annular collar 6. An especially suitable spring characteristic can be achieved due to the annular collar 6, which is thus designed in the manner of folded bellows. In addition, with appropriate dimensioning of this profile and the sealing face, several ring-shaped peaks or edges which are located on the inside radially come to rest on the sealing face 10, thus forming a seal, so that several seals which act radially are connected in series, and thus the sealing effect can be increased.

Again in these embodiments, a reduction in the distance between the supporting contour 11 and the respective end disk 3 causes an increase in the preliminary tension on the sealing lip(s) which is/are designed on the inside radially, thus increasing the sealing effect accordingly.

In the case of the filter body 1 according to this invention, a thermoplastic elastomer based on polyester (TEEE) is preferably used to produce the one-piece injection-molded unit comprised of end disk 3 and annular collar 6. Such a plastic is available commercially under the brand name Hytrel®. Hytrel is stable up to at least 90 °C, and in particular it has reversible elasticity, so that air filters and hydraulic filters can be produced with end disks 3 made of this plastic and equipped with seal 9 in one piece. It is clear that the filter body 1 according to this invention can also be used as a fuel filter or an oil filter or the like, in particular when a plastic that is stable at the temperatures occurring under such conditions is used to produce the unit consisting of the end disk 3, annular collar 6 and seal 9.

CLAIMS

1. A filter body of a fluid filter, especially an air filter having the following features:

- the filter body (1) has a tubular cylindrical filter element (2) made of a filter material,

- an end disk (3) is mounted on at least one axial end of the filter element (2),

- the end disk (3) has a seal (9) which acts radially and which comes to rest radially on a cylindrical sealing face (10) in the case of a filter body (1) inserted into a filter housing, said sealing face being arranged coaxially with respect to the filter body (1),

- the end disk (3) has supporting means (6, 15) extending in a ring-shaped design on the outside axially of the end disk (3) with respect to the filter element (2),

- the supporting means (6, 15) are designed with axial elasticity and are supported on a supporting contour (11) which is formed on the filter housing and extends parallel to the end disk (3) in the case of a filter body (1) inserted into the filter housing, so that the filter body (1) is positioned axially in the filter housing,

characterized by the following features:

- the supporting means have an annular collar (6) which projects axially outward away from the end disk (3) with respect to the filter element (2)

and is designed with axial elasticity in an axial section (15),

- in the case of a filter body (1) inserted into the filter housing, the elastic section (15) is supported axially on the supporting contour (11),

- annular collar (6) and end disk (3) are made of an injection-molded plastic in one piece.

2. The filter body according to claim 1,

characterized in that

the annular collar (6), the end disk (3) and the seal (9) are designed as an injection-molded unit made of plastic in one piece.

3. The filter body according to claim 1 or 2,

characterized in that

the seal (9) is formed on the annular collar (6).

4. The filter body according to claim 3,

characterized in that

the seal (9) and the annular collar (6) work together in such a way that an increasing axial deformation of the annular collar (6) causes an increasing radial adjustment of the seal (9) in the direction of its radial sealing effect.

5. The filter body according to one of claims 2 - 4,

characterized in that

the unit comprising the annular collar (6) and the seal (9) consists of at least two axial sections (7, 8) which are joined together by a connecting section (9), where the connecting section forms a ring-shaped sealing lip (9) which acts radially inward, and the axial section (7) arranged at a greater distance away axially is supported on the supporting contour (11), with the axial section (7) which is arranged farther toward the outside axially being inclined away from the sealing face (10), starting from the sealing lip (9), while the axial section (8) which is arranged farther inward axially runs at an inclination toward the sealing face (10), starting from the sealing lip (9).

6. The filter body according to one of claims 1 - 5,

characterized in that

the annular collar (6) has a corrugated or zigzag-shaped profile in a central longitudinal section.

7. The filter body according to one of claims 1 - 6,

characterized in that

the filter body (1) has an inner frame (13) which supports the filter element (2) radially and supports the end disks (3) axially.

8. The filter body according to at least claim 5,

characterized in that

a unit comprising the material thickness of the seal (9) and the annular collar (6) measured in the profile decreases in the direction of the connecting section

(9) with an increase in the distance from the end disk (3) in the axial section (8) facing the end disk (3) and is essentially constant in the axial section (7) which faces away from the end disk (3).

9. The filter body according to one of the preceding claims,

characterized in that

the sealing face (10) is formed by a cylindrical outer jacket of a connection (22) which extends inside the filter housing coaxially with the filter body (1), and the end disk (3) has a central opening (4) on whose inside edge (5) the annular collar (6) is provided.

10. The filter body according to one of the preceding claims,

characterized in that

both axial ends of the filter element (2) are equipped with one of these end disks (3), so that the filter body (1) inserted into the filter housing is centered axially in the filter housing.

11. The filter body according to according to one of the preceding claims,

characterized in that

TEEE is used to produce the unit consisting of the end disk (3) and the annular collar (6).

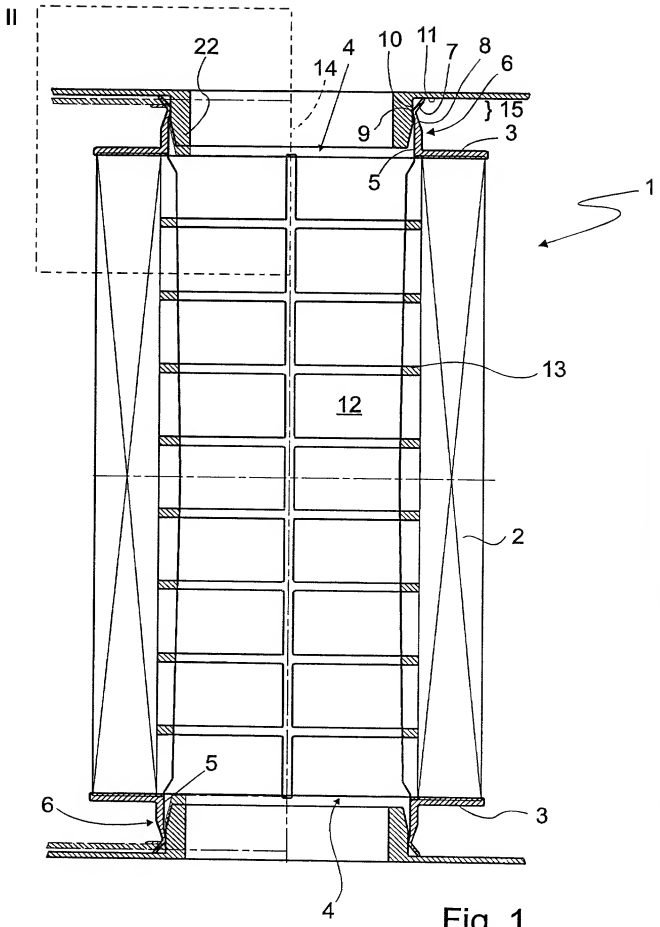

Fig. 1

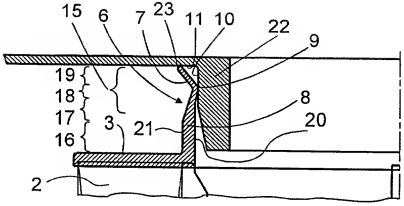

Fig. 2

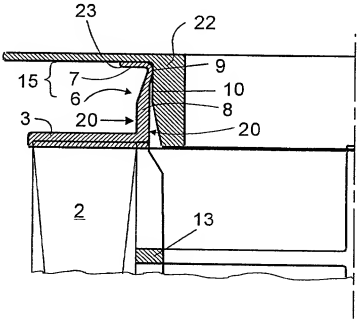

Fig. 3

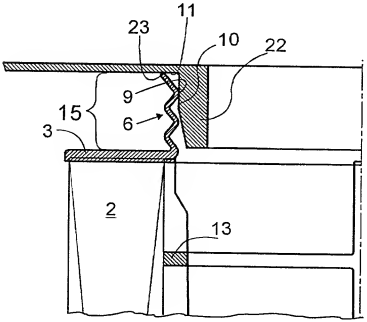

Fig. 4

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY
(Includes Reference to PCT International Applications)

ATTORNEY'S DOCKET NUMBER
GEBLER ET AL 1 PCT

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

FILTER BODY OF A FLUID FILTER, ESPECIALLY AN AIR FILTER

the specification of which (check only one item below):

[ ] is attached hereto.

[ ] was filed as United States application

Serial No. _____

on _____,

and was amended

on _____ (if applicable).

[X] was filed as PCT international application

Number PCT/DE00/02445

on 25 JULY 2000,

and was amended under PCT Article 19

on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT, indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
GERMANY	**199 35 297.6**	**27 JULY 1999**	[X] YES [ ] NO
			[ ] YES [ ] NO
			[ ] YES [ ] NO
			[ ] YES [ ] NO

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY
(Includes Reference to PCT International Applications)

ATTORNEY'S DOCKET NUMBER

GEBLER ET AL 1 PCT

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclose in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS *(Check One)*		
U.S. APPLICATION NUMBER	U.S FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S					
PCT APPLICATION NO	PCT FILING DATE	U.S SERIAL NUMBERS ASSIGNED *(if any)*			

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration numbers):

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2	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
0	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
3	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
Claude Friedrich C. F. Gebler	Horst Schneider	
DATE	DATE	DATE